**Avaya Solution & Interoperability Test Lab**

# Application Notes for RAD IPmux-14 TDMoIP Gateway with Avaya Communication Manager - Issue 1.0

## Abstract

These Application Notes describe the configuration steps required to support DS1 Converter remote Port Network connectivity over an IP network using the RAD Data Communication IPmux-14 TDMoIP Gateway and Avaya S8700 Media Server Multi-Connect configuration running Avaya Communication Manager. Features and functionality were validated and performance testing was conducted in order to verify operation under load. Information in these Application Notes has been obtained through interoperability compliance testing and additional technical discussions. Testing was conducted via the Developer*Connection* Program at the Avaya Solution and Interoperability Test Lab.


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# 1. Introduction

These Application Notes describe the compliance-tested configuration utilizing RAD Data Communication's IPmux-14 TDMoIP Gateway and Avaya S8700 Media Server Multi-Connect configuration running Avaya Communication Manager, to transport DS1 Converter Remote Port Network connectivity (T1/E1s) over an IP network.

RAD IPmux-14 is a TDMoIP gateway that enables the TDM E1/T1 circuits to be extended over an IP/Ethernet network by extending voice and signaling protocols transparently over packet networks. The IPmux-14 provides Circuit Emulation (CE) services over IP using TDMoIP (CE). The device supports 1 to 4 T1 or E1 TDM facilities and converts the data streams coming from its TDM ports into packets that are extended over the Fast Ethernet network port, and vice versa.

Avaya S8700 Media Server Multi-Connect configuration provides for remote Port Networks (remote PNs) which are remotely located from the main Port Network (main PN). Remote PNs located within 5 miles may be coupled using fiber-optic cable. When the remoting distance between the main PN and the remote PN exceeds 5 miles, coupling is provided using a DS1 Converter Complex. A DS1 Converter Complex consists of a pair of DS1 Converter boards (TN1654) and their associated T1/E1 facilities. The Converter Complex is installed in place of the conventional fiber and supports from 1 to 4 T1 or E1 facilities, providing a total of 92 T1 channels (or 120 E1 channels) in each direction between the main PN and the remote PN.

The compliance testing focused on transporting T1/E1 facilities associated with the DS1 Converter boards over an IP network utilizing RAD IPmux-14 TDMoIP Gateway.

## 1.1. Sample Network Configuration

The tested network configuration is shown in **Figure 1**.

The network is configured for two locations – the main site and the remote site. The main site consists of Avaya S8700 Media Server Multiconnect configuration that includes an Avaya MCC1 Media Gateway, which will be referred to as the main Port Network (main PN). The remote site consists of Avaya SCC1 Media Gateway, which will be referred to as a remote PN. An Avaya DS1 Converter TN1654 board is installed in the main PN and another TN1654 board is installed in the remote PN. Four T1 (E1) links are provided between these two DS1 Converter boards over an IP network. The IP transport of T1/E1 is enabled by a RAD IPmux-14 device at each site. The IP network consists of an Avaya P333R Stackable Switch at the main site and an Avaya P333T stackable switch at the remote site. At each site, the TDM side of the IPmux-14 is connected to the DS1 Converter board via 4 T1 (E1) cables, and the IP side is connected to an Avaya Stackable switch. Both the main PN and the remote PN support a mix of analog, digital and IP phones, and fax machines. Another fax machine is also connected in the public network. A modem for making data calls is supported in the remote PN.


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Both the main PN and remote PN derive synchronization from a common public source - a public T1 (E1). At the main site, a public network T1 (E1) is connected to a T1 (E1) board in the Avaya MCC1 Media Gateway. At the remote site, a public network T1 (E1) is connected to an External port on the RAD IPmux-14 device, and this device transmits the synchronization clock to the Avaya SCC1 Media Gateway via the T1 (E1) links associated to the DS1 Converter board. This configuration is also applicable to Avaya DEFINITY® Servers that support DS1 Converter TN1654 Complex.

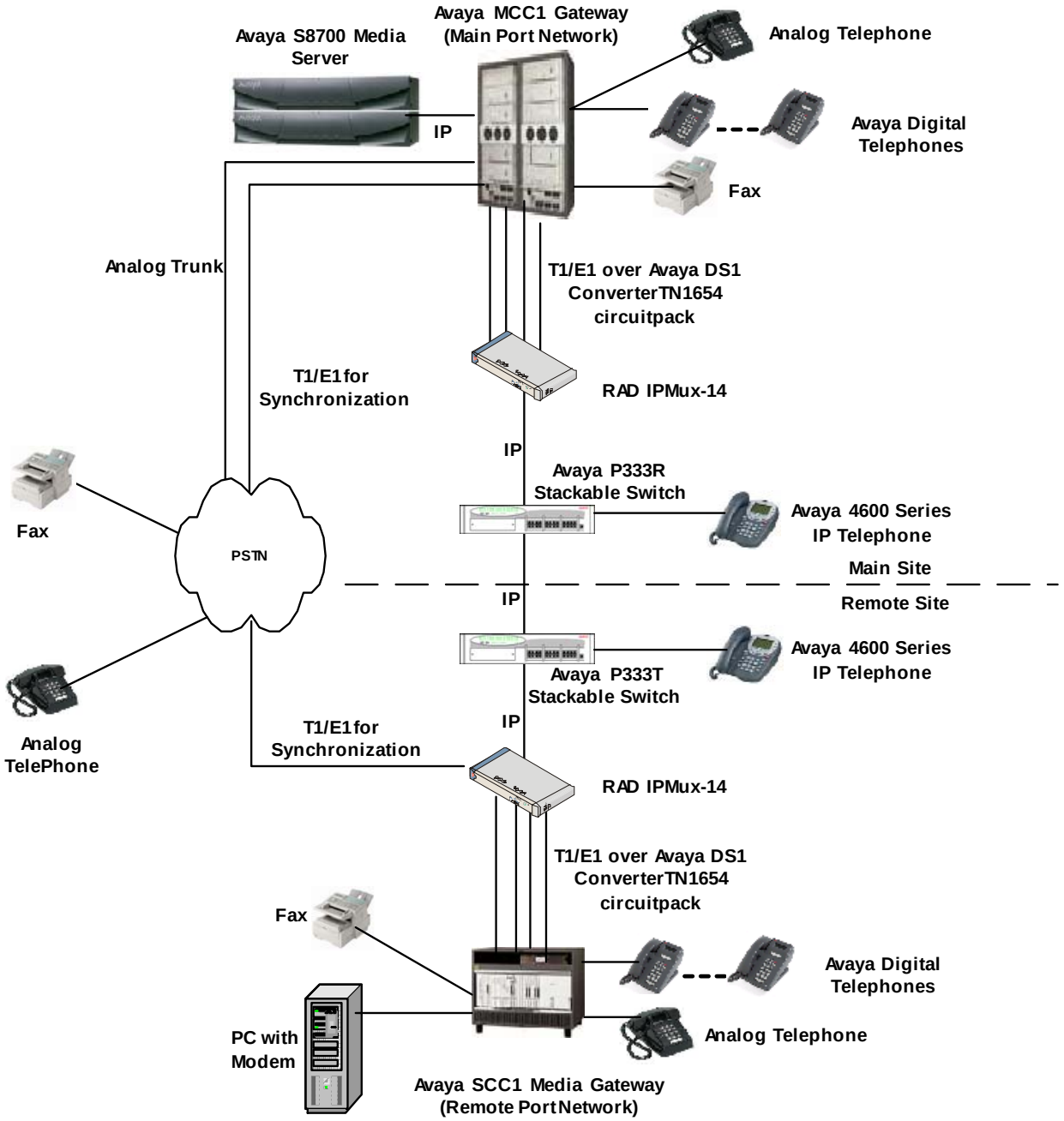


**Figure 1: Network Configuration**


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# 2. Equipment and Software Validated

The following equipment and software/firmware were used for the sample configuration provided:

| Equipment | Software/Firmware |
|---|---|
| Avaya S8700 Media Server in MultiConnect Configuration | 2.0.1 (R012x.01.0.221.1) |
| Avaya MCC1 Media Gateway (main Port Network)<br>• Switch Node Interface TN573B<br>• DS1 Converter TN1654 with "special" Y cable | <br>V4<br>V6 |
| Avaya SCC1 Media Gateway (remote Port Network)<br>• Expansion Interface TN570B<br>• DS1 Converter TN1654 with "special" Y cable | <br>V8<br>V6 |
| Avaya P333R Multilayer Stackable Switch | 3.9.1 |
| Avaya P333T-PWR Power over Ethernet Stackable Switch | 4.0.17 |
| Avaya 4612 IP Telephones | 1.8.1 |
| Avaya 8410D Digital phones using TN2224B | V5 |
| Analog phones | |
| Analog trunk (Central Office) | |
| AvayaT1/E1 trunk circuit packs - TN464F | V16 |
| Synchronization source from public network<br>• TN464F T1/E1 | |
| RAD IPmux-14 TDMoIP Gateway | 1.0 |

# 3. Configure IPmux-14 TDMoIP Gateway

The IPmux-14 is configured via a terminal control session. There are four basic configuration steps that need to be followed when deploying IPmux-14, as follows:

1. IP Configuration – Setting the device host IP address
2. Physical layer configuration – Setting the TDM parameters (line type, synchronization, etc.).
3. Creating bundles – Allocating timeslots to bundles.
4. Connecting bundles – Directing the bundles to remoteIPmux-14 unit.


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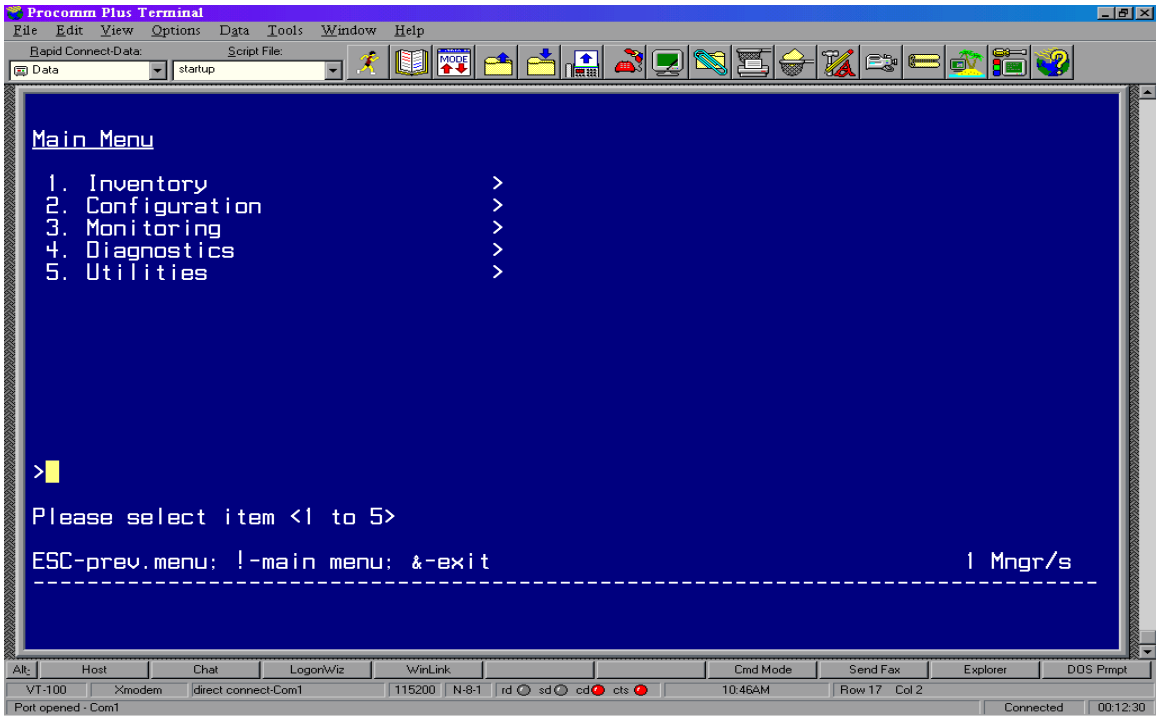
## 3.1. Managing IPmux-14 via Terminal Control Session

| Step | Description |
|---|---|
| **1.** | a. Connect IPmux-14 to a PC equipped with an ASCII terminal emulation application (for example Procomm).<br>b. Launch the terminal emulator application and set its port parameters to 115.2kbps, 8 bits/character, 1 stop bit, and no parity. Set the terminal emulator to ANSI VT100 emulation.<br>c. Login as a superuser, entering **user name** as **su** and appropriate password.<br>d. A main menu appears.<br>  |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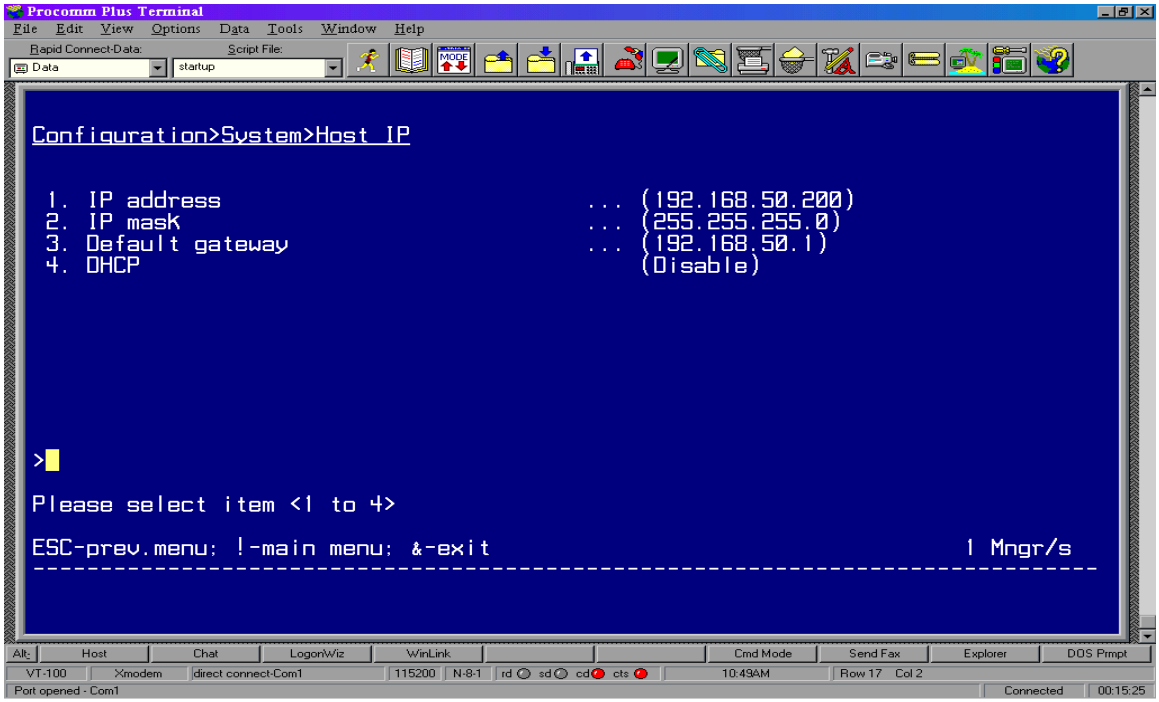
## 3.2. Configure IP Parameters

| Step | Description |
|---|---|
| **1.** | a. Display the Host IP menu (**Configuration > System > Host IP)**, and configure the IP address and the mask of the host.<br>b. In the following example, the Host IP address is 192.168.50.200, the IP mask is 255.255.255.0, and the Default gateway is 192.168.50.1. The Host IP address of the IPmux-14 unit at remote site (not shown here) is 192.168.60.200 and the IP mask is 255.255.255.0.<br>  |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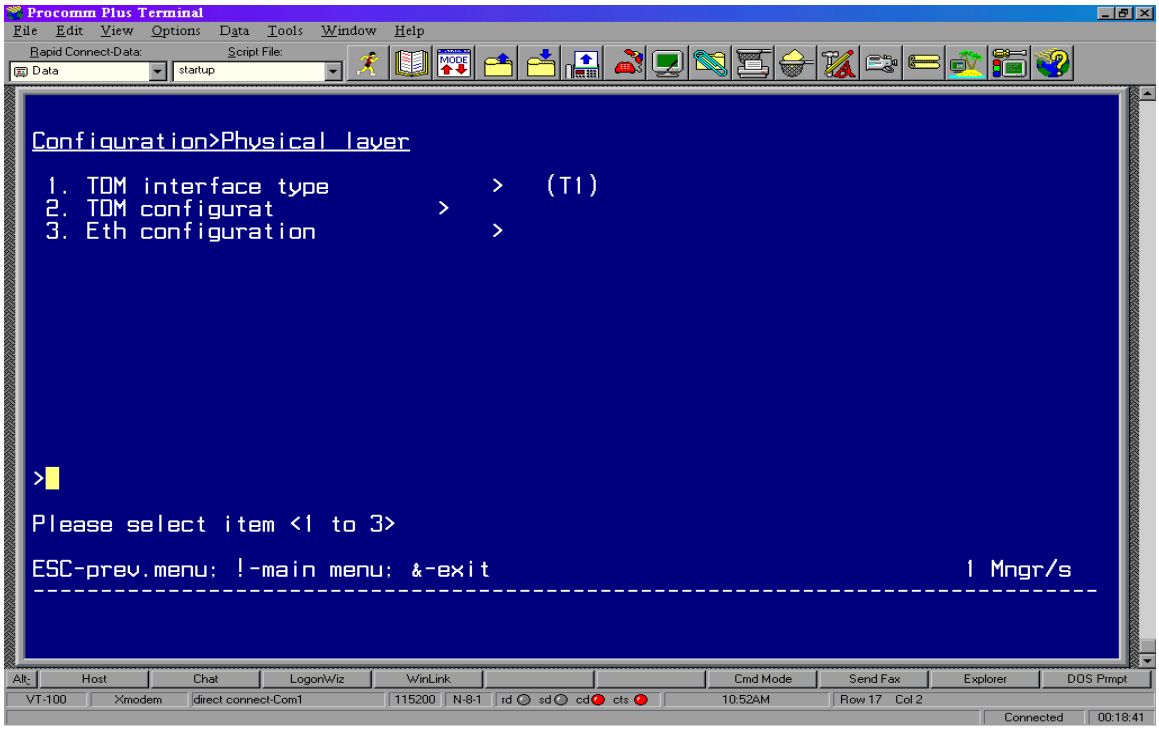
## 3.3. Configure T1/E1 Parameters at the Physical Layer

| Step | Description |
|---|---|
| **1.** | **Configure T1 or E1**<br>a. Display the Physical Layer menu (**Configuration > Physical layer)**<br>b. Configure the **TDM Interface Type** as **T1** or **E1**. In the following example, the TDM interface type is set to T1.<br>  |
| **2.** | **Select a T1/E1 for TDM Configuration**<br>a. Display the TDM Configuration menu (**Configuration > Physical layer > TDM Configuration**)<br>b. Type **F** to select one of the four T1 or E1 interfaces. |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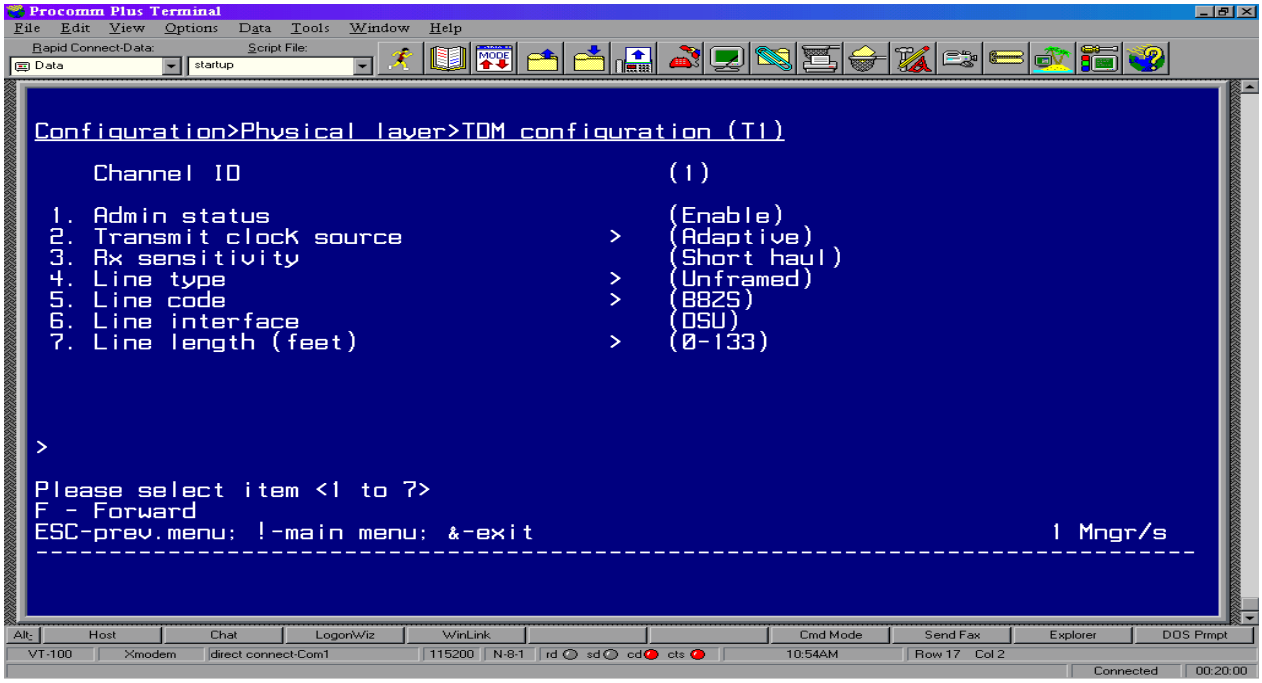
| Step | Description |
|---|---|
| 3. | **TDM Configuration**<br>Configure the following TDM parameters for a T1 or E1.<br>**a. Admin Status:** Admin Status **–** set it to **Enable**. This enables the T1/E1 link.<br>**b. Transmit clock source –**<br>**a.** For the IPmux-14 at the r*emote site*, set the clock source to **External.** Make sure the External clock port on the IPmux-14 at the remote site is connected to a public T1 (or public E1). See Section 4.2 for more details on clocking (Synchronization).<br>**b.** For the IPmux-14 at the *main site*, set the clock source to **Adaptive**.<br>**c. Line type – Unframed G.703** (for E1) or **Unframed** (for T1).<br>**d. Line code – b8zs** for T1. This field is not displayed for E1 and is internally set to **hdb3**.<br><br>The following example shows a T1 configuration for an IPmux-14 at *main* site.<br><br>**Note:** The Transmit clock source is set to **Adaptive**<br><br>  <br><br><br>The T1 configuration at the remote site is the same as above, except that the Transmit clock source is set to **External**. |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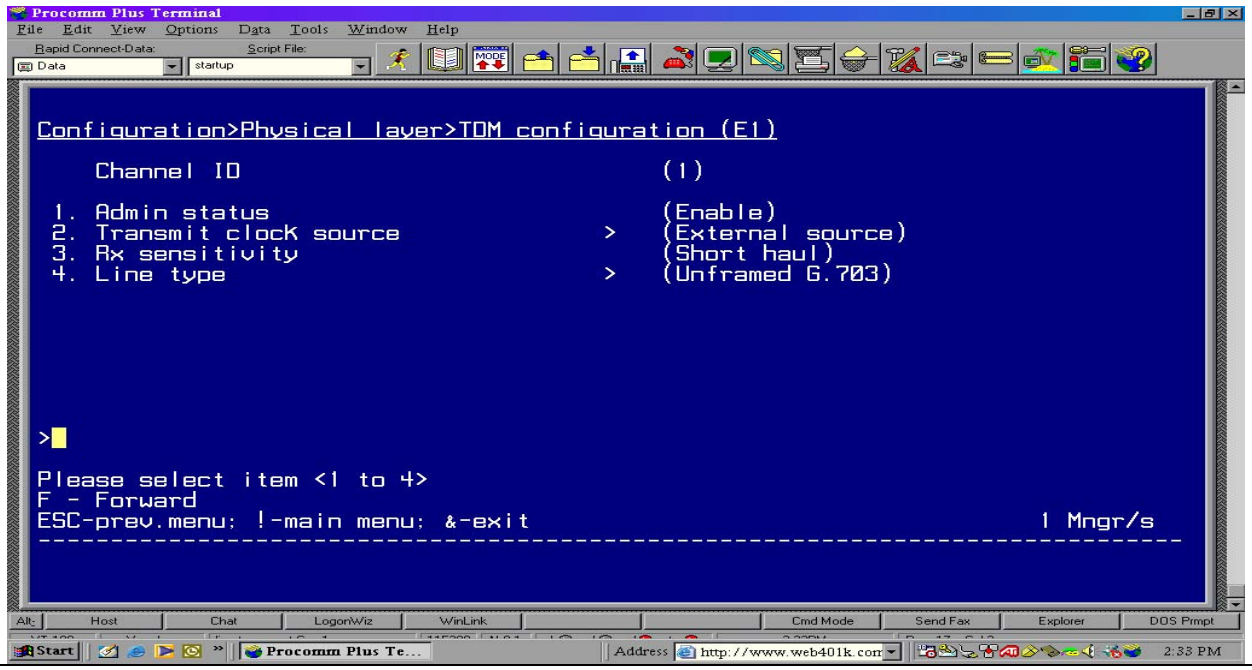
| Step | Description |
|---|---|
| **4.** | The following example shows the E1 configuration for an IPmux-14 at the r*emote* site.<br><br>**Note:** The **Line type** is configured as **Unframed G.703** and the **Transmit clock source** is set to **External source**.<br><br>  |

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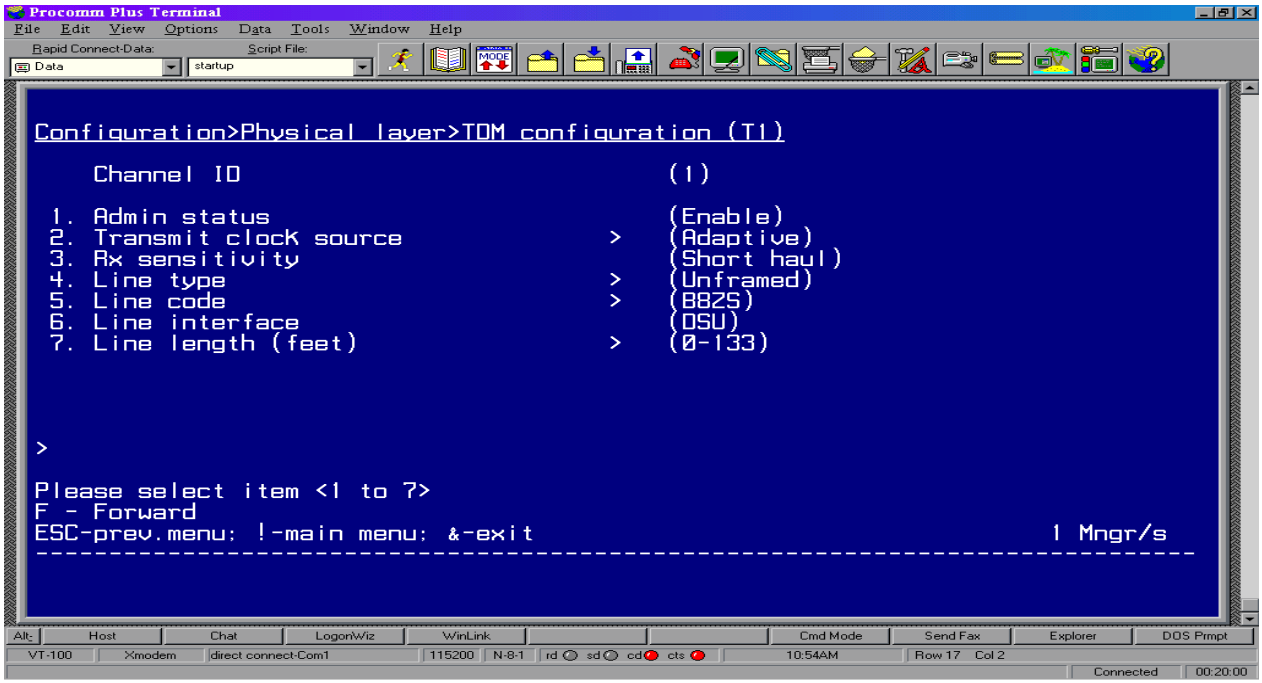
| Step | Description |
|---|---|
| **5.** | The following example shows a T1 configuration for an IPmux-14 at *main* site.<br><br>**Note:** The **Transmit clock source** is set to **Adaptive**<br><br>  |

Procomm Plus Terminal
File Edit View Options Data Tools Window Help
Rapid Connect-Data:
Data
Script File:
startup
Configuration>Physical layer>TDM configuration (T1)
Channel ID (1)
1. Admin status (Enable)
2. Transmit clock source > (Adaptive)
3. Rx sensitivity (Short haul)
4. Line type > (Unframed)
5. Line code > (B8ZS)
6. Line interface (DSU)
7. Line length (feet) > (0-133)
>
Please select item <1 to 7>
F - Forward
ESC-prev.menu: !-main menu: &-exit
1 Mngr/s
Alt: Host Chat LogonWiz WinLink Cmd Mode Send Fax Explorer DOS Prmpt
VT-100 Xmodem direct connect-Com1 115200 N-8-1 rd sd cd cts 10:54AM Row 17 Col 2
Connected 00:20:00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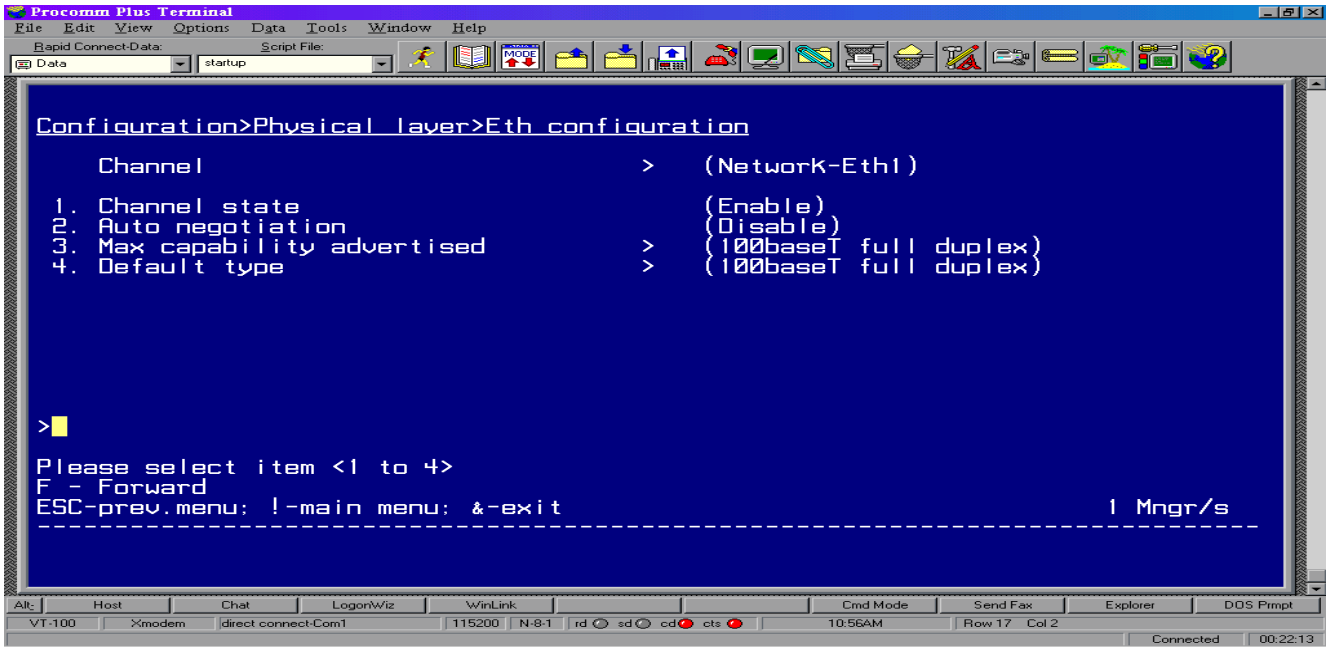
## 3.4. Configure Ethernet Parameters

| Step | Description |
|---|---|
| **1.** | Configure an Ethernet port for network interface to an IP network, as in the following example:<br><br>a. Display the ETH Configuration menu (**Configuration > Physical layer > Eth Configuration)**<br>b. Type **F** to select the Ethernet interface to be configured. Select **Network=Eth1.**<br>c. Configure the following parameters:<br>• **Channel State:** set it to **Enable.**<br>• **Auto Negotiation:** set it Enable or Disable. In the following example, it is set to **Disable**.<br>• **Max capability advertised:** Set it to 10BaseT or 100BaseT. In the following example, it is set to **100baseT full duplex.**<br>• **Default type:** Set it to 10BaseT or 100BaseT. In the following example, it is set to **100baseT full duplex.**<br><br>  |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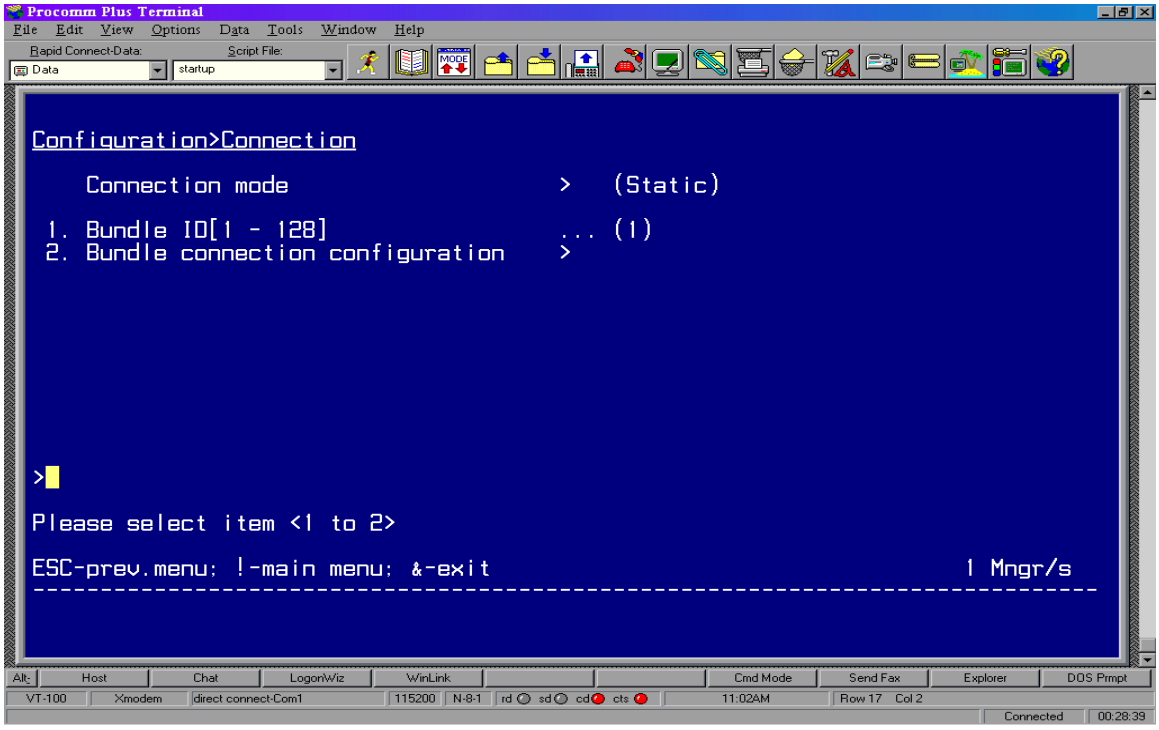
## 3.5. Configure Bundle Connections

IPmux-14 associates each T1 (E1) with a bundle. Select a bundle on the IPmux-14 at the main site, and configure it to connect to the bundles on the IPmux-14 unit at the remote site.

| Step | Description |
|---|---|
| **1.** | **Select a Bundle ID**<br>a. Display the Connection menu (**Configuration > Connection).**<br>b. Select **a Bundle ID**. By selecting a bundle number, a TDM link (1-4) is specified.<br>c. In the following example, **Bundle ID 1** specifies the first TDM (T1) link.<br>  |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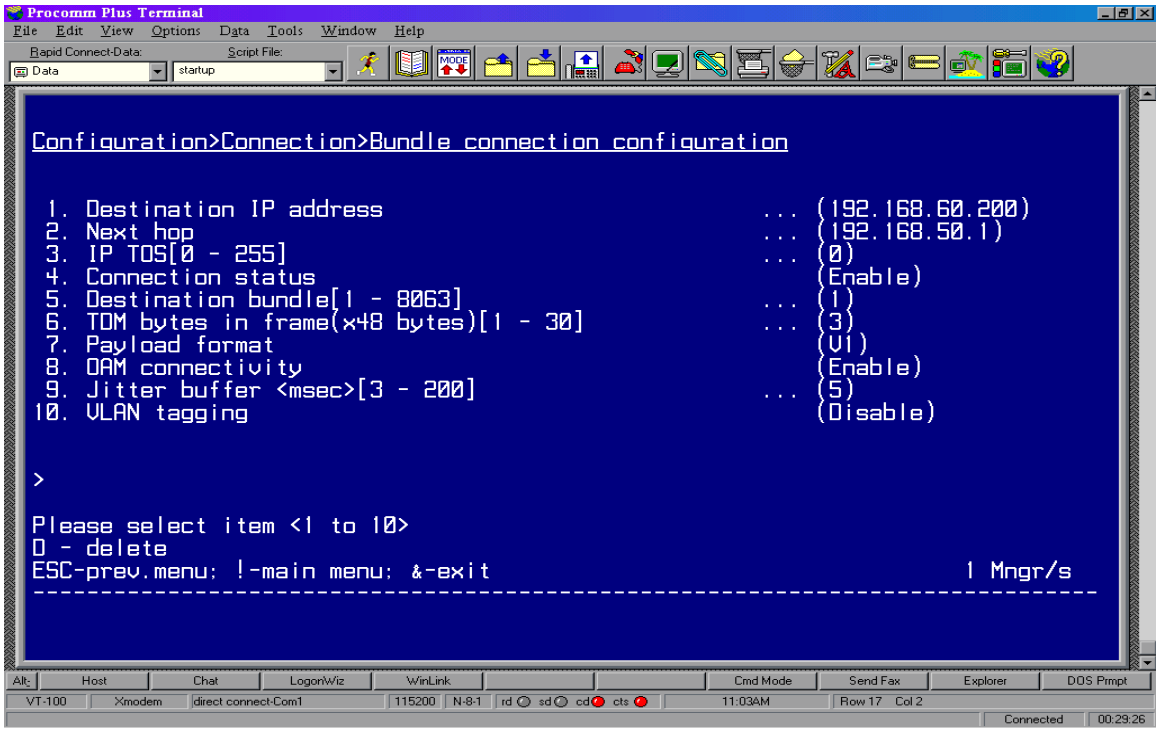
| Step | Description |
|---|---|
| **2.** | **Connect the bundles**<br>Display the Bundle connection configuration menu (**Configuration > Connection > Bundle connection configuration**). Configure the following parameters:<br>a. **Destination IP address** – IP address of IPmux-14 at remote site. For example, 192.168.60.200<br>b. **Next Hop** – For example, 192.168.50.1.<br>c. **Connection Status** – **Enable**.<br>d. **Destination bundle** – For example **1**.<br>e. **OAM Connectivity – Enable.** The device starts transmitting at full rate after it detects an active unit on the other side of the line.<br>f. **Jitter Buffer – 5** msec. This sets the desired depth of the jitter buffer.<br>  |
| **3.** | Repeat steps 1 and 2 for other TDM links. |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# 4. Configure Avaya Communication Manager

Avaya Communication Manager can be configured via a System Access Terminal (SAT). There are two basic configuration steps that need to be followed when the DS1 Remote Port Connectivity application is deployed:

1. Configure Fiber link - The DS1 Converter Complex is installed in place of the conventional fiber. The configurartion of the DS1 Converter complex is done by configuring the conventional fiber link, administering the DS1 Converter related parameters.
2. Synchronization – Configure and verify that the main PN and remote PN derive synchronization from a common source.

## 4.1. Configure Fiber Link

Before configuring Avaya Communication Manager for DS1 remote Port Network connectivity, make sure that the relevant hardware is installed as follows:

On main PN,

- Switch Node Interface TN573B board, (e.g., in carrier slot **1E20**).
- DS1 Converter TN1654 board, (e.g., in carrier slot **1E21**).
- Connect TN573B and TN1654 with a TN1654 Y cable.

On remote PN,

- Expansion Interface TN570B board, (e.g., in carrier slot **11A01**).
- DS1 Converter TN1654 board, (e.g., in carrier slot **11A02**).
- Connect TN570B and TN1654 with a TN1654 Y cable.

### 4.1.1. Configure the T1 Facility

Each DS1 Converter TN1654 board supports up to 4 T1 facilities, named as DS1C facility A, B, C and D respectively. Set the dipswitches on the board for T1 operation for all the DS1C facilities.

The fiber-link administration in Avaya Communication Manager is used for configuring the DS1C connection between the main PN and the remote PN. Consider the main PN and the remote PN as the two endpoints connected via a “fiber link”. From the System Access Terminal (SAT), administer a fiber link using the **add fiber-link x,** where x is the fiber link number. Configure the location of the boards on each Endpoint that will be connected to form a fiber link, and the parameters associated with each T1 facility.

The following example adds fiber-link number **11** to connect the main PN (Endpoint 1) to remote PN (Endpoint 2):


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- Set the field **Is one endpoint remoted via DS1 Converter Complex?** to **yes.** This enables the configuration of 'fiber connectivity' over the T1s using the DS1 Converter board and pops up the related fields on the form.
- For Endpoint 1 (main PN),
  - Set the board location for the switch node interface (sni) by setting **Board Location** field. For example, the location of the sni board is **1E20.**
  - Set the DS1 Converter board location by setting **DS1CONV Board Location** field. For example, the location of the DS1 Converter is **1E21.**
- For Endpoint 2 (remote PN),
  - Set the board location for the expansion interface (ei) by setting **Board Location** field. For example, the location of the EI board is **11A01.**
  - Set the DS1 Converter board location by setting **DS1CONV Board Location** field. For example, the location of the DS1 Converter is **11A02.**
- Set **Converter** to **Yes ,** the **Type field** to **Avaya,** and the **Type of Transceivers** to **A**

The following SAT screen displays Page 1 of the fiber-link configuration:

```
display fiber-link 11                                          Page   1 of   2
                          FIBER LINK ADMINISTRATION

Fiber Link #: 11
Is one endpoint remoted via DS1 Converter Complex? yes

            ENDPOINT-1                              ENDPOINT-2
             (A-PNC)                                 (A-PNC)
        Board Location: 01E20                   Board Location: 11A01
        Board Type: sni                         Board Type: ei
        DS1CONV Board Location: 01E21           DS1CONV Board Location: 11A02
        DS1CONV Board Type: TN1654              DS1CONV Board Type: TN1654









        Fiber Translation:                      Converter? yes
        Type of Transceivers: A                 Converter Type: Avaya
```

On the second page of the **add fiber-link x** form, configure the T1 parameters for each T1 facility, as follows:

- Set **Facility Installed** to **Yes** for each T1 facility that is connected via T1 cable to RAD IPmux-14 device. In this example, all the T1s (A, B, C and D) are installed and connected.
- Set the **Bit Rate** field to **1.544**. This sets all the ports on DS1 Converter board to T1.
- Set the **Line Coding** to **b8zs** for all the facilities.


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The following SAT screen displays page 2 of the fiber-link configuration:

```
display fiber-link 11                                          Page   2 of   2
                          FIBER LINK ADMINISTRATION
                    A-PNC DS1 CONVERTER (DS1CONV) ATTRIBUTES

DS1CONV Board Location: 01E21                 DS1CONV Board Location: 11A02
DS1CONV Board Type: TN1654                    DS1CONV Board Type: TN1654

                             DS1 CONVERTER FACILITIES

                              A         B         C         D
         Facility Installed?  yes       yes       yes       yes
                    Bit Rate:  1.544
 Facility Startup Idle Code:  11101000
                  Line Coding:  b8zs      b8zs      b8zs      b8zs
                Framing Mode:
DS1CONV-1 Line Compensation:  1         1         1         1
DS1CONV-2 Line Compensation:  1         1         1         1

Facility A Circuit ID: RAD A
Facility B Circuit ID: RAD B
Facility C Circuit ID: RAD C
Facility D Circuit ID: RAD D
```

### 4.1.2. Configure the E1 Facility

Configuring the E1 facility follows the same steps described in Section 4.1.1, with the following differences:

- The dipswitches on TN1654 board are set for E1.
- On the fiber-link form, set the **Bit Rate** to **2.048** and **Line Coding** to **hdb3**.

The following SAT screen displays page 2 of the fiber-link configuration:

```
display fiber-link 11                                          Page   2 of   2
                          FIBER LINK ADMINISTRATION
                    A-PNC DS1 CONVERTER (DS1CONV) ATTRIBUTES

DS1CONV Board Location: 01E21                 DS1CONV Board Location: 11A02
DS1CONV Board Type: TN1654                    DS1CONV Board Type: TN1654

                             DS1 CONVERTER FACILITIES

                              A         B         C         D
         Facility Installed?  yes       yes       yes       yes
                    Bit Rate:  2.048
 Facility Startup Idle Code:  11101000
                  Line Coding:  hdb3      hdb3      hdb3      hdb3
                         CRC?  no
           Line Termination:  75/*      75/*      75/*      75/*
```


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## 4.2. Synchronization

For successful operation of this application, it is imperative that:

- Both the main PN and the remote PN derive synchronization from a facility that can be traced to a common public source - a public T1 (E1).
- The remote PN must derive the synchronization from the DS1-C facility on a DS1 Converter board resident in the remote PN.

As described in Section 1.1, at the main site, a public network T1 (E1) is connected to a T1 (E1) board in the Avaya MCC1 Media Gateway to provide Synchronization to the main PN. All the boards on the main PN derive synchronization from this common source, including the DS1 Converter board.

At the remote site, the remote PN must derive synchronization from the DS1-C facility, which can be traced to a common source such as Public T1. Normally the DS1-C facility at the remote site is connected to the public network, and hence it can derive synchronization from a public T1. However, in this application, the DS1-C facility is connected to an IPmux-14, and IPmux-14 is connected to an IP network. The IP network cannot provide (or transport) the T1 Synchronization. The alternative is using the External Clock timing mode supported by IPmux-14. Connect a public network T1(E1) to an External port on RAD IPmux-14 device at remote site. This results in IPmux-14 deriving synchronization traceable to a common public source, and in turn this device transmits the synchronization clock to the remote PN via the T1 (E1) links associated with the DS1 Converter board.

### 4.2.1. Configure the Main PN Synchronization Source

Using the SAT, configure the Synchronization Source for main PN by using the **change synchronization** command. For the **Primary** field, enter the location of the T1 (or E1) board that is connected to the public network. In the following example the **Primary** is set to **01C15.**

```
change synchronization                                      Page   1 of  10
                          SYNCHRONIZATION PLAN

               SYNCHRONIZATION SOURCE (circuit pack location)

                    Stratum: 4

                    Primary: 01C15      Secondary:

                CIRCUIT PACKS AVAILABLE FOR SYNCHRONIZATION
Location  Type  Name             Slip      Location  Type  Name             Slip
03C17     DS1   Abacus b18 PRI   n         02C17     DS1   Abacus b12 PRI   n
03B08     DS1   isdn pri 2       n         02C16     DS1   Abacus b11 PRI   n
03B07     DS1   isdn pri 1       n         01D17     DS1   Abacus-PBX27     n
03C16     DS1   Abacus b17 PRI   n         02B15     DS1   Abacus-PBX27     n
03C15     DS1   Abacus b16 PRI   n         02B16     DS1   Abcus            n
02D17     DS1   Abacus b15 PRI   n         02B18     DS1   Abacus           n
```

Synchronization can also be derived from another Avaya Media Gateway, e.g., System G, as long as System G is deriving synchronization from a public network. In that case, connect a T1 between the


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main PN and the System G, and configure the T1 (DS1) on the main PN using **add ds1** command via SAT, as follows:

```
add ds1 c15                                                  Page   1 of   2
                              DS1 CIRCUIT PACK

            Location: 01C15                          Name: synch for main PN
            Bit Rate: 1.544                   Line Coding: b8zs
   Line Compensation: 1                      Framing Mode: esf
      Signaling Mode: isdn-ext



Interface Companding: mulaw
           Idle Code: 11111111




      Slip Detection? n                Near-end CSU Type: other
```

Here the T1 board in slot 01C15 is connected to a T1 board in another Avaya Media Gateway.

### 4.2.2. Remote PN Synchronization

As stated in Section 4.2, connect the External Clock port on the IPmux-14 to a T1 from public network (a common source to the main PN).

To verify that the remote PN is deriving synchronization from the DS1-C facility on the DS1 Converter board, enter the **test tone-clock x long** command on SAT, where x is the location of the tone-clock board on the remote PN. In the following example, the tone-clock board for remote PN is **11a.** Verify that the **test number 150** is passed.

```
test tone-clock 11a long

                                TEST RESULTS

Port        maintenance Name  Alt. Name Test No. Result            Error Code

11AXX07     ETR-PT                      42       PASS
11AXX07     ETR-PT                      43       PASS
11AXX08     ETR-PT                      42       PASS
11AXX08     ETR-PT                      43       PASS
11A         TDM-CLK                     148      PASS
11A         TDM-CLK                     150      PASS
11A         TDM-CLK                     151      PASS
11A         TDM-CLK                     574      PASS
11A         TONE-PT                     90       PASS
11A         TONE-PT                     40       PASS
```


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To further validate the quality of the Synchronization source, enter **list measurements ds1-facility summary xy** command on SAT, where x is the location of the DS1 Converter board in the remote PN and y is the DS1-C facility name on that board such as A, B, C or D. Verify that there are no **Errored Seconds** or **Severely Errored Seconds**. The following example lists the measurements for the DS1-C facility A (**11a02a**) on the remote PN.

```
list measurements ds1-facility summary 11a02a

Switch Name: SIL-pbx27                        Date: 1:03 pm  FRI OCT 15, 2004

          DS-1 FACILITY LINK PERFORMANCE MEASUREMENTS SUMMARY REPORT

                                Counted Since: 10:40 am  FRI OCT 15, 2004
  Valid 15-Minute Intervals in Last 24 Hours: 7
        Seconds Elapsed In Current Interval: 406   ESF Error Events: N/A
  Test: N/A                           Pattern: N/A       Synchronized: N/A
         Loopback/Span Test Bit-Error Count: N/A      Test Duration: N/A

                            Worst 15-Minute Interval  24-Hour  Current
            Category           Date   Time   Count    Count    Interval Count

            Errored Seconds    10/15  12:40  0        0        N/A
      Bursty Errored Seconds   10/15  12:40  0        0        N/A
    Severely Errored Seconds   10/15  12:40  0        0        N/A
  Unavailable/Failed Seconds   10/15  12:40  0        0        N/A
     Controlled Slip Seconds   N/A    N/A    N/A      N/A      N/A
         Loss Of Frame Count   N/A    N/A    N/A      N/A      N/A
```

### 4.2.3. Primary DS1-C Facility

The DS1-C facility carrying control and signaling traffic is called a Primary DS1-C facility. Only DS1-C facility A or B can be a Primary facility. When A is the Primary facility and it goes down, the signaling and control traffic is switched to B, making B the Primary facility, and vice versa. Use **"list fiber-link"** command via SAT to verify the current **Primary Facility**. In the following example, the **Primary Facility** is **B.**

```
list fiber-link

                          FIBER LINK ADMINISTRATION

FIBER -------- ENDPOINT 1 --------  -------- ENDPOINT 2 --------
LINK# TYPE A-PNC DS1   B-PNC DS1    TYPE A-PNC DS1   B-PNC DS1    DS1
           LOC   CONV  LOC   CONV        LOC   CONV  LOC   CONV   CONV
                 LOC         LOC              LOC         LOC    TYPE

 1    sni  01E02                    ei   01B02

 2    sni  01E03                    ei   02A01

 11   sni  01E20 01E21              ei   11A01 11A02              TN1654
Primary Facility:B
```


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# 5. Interoperability Compliance Testing

The interoperability compliance testing focused on transporting the T1/E1s utilized for Avaya DS1 Converter Remote Port Network connectivity, over an IP network using the RAD IPmux-14 TDMoIP Gateway device. The testing was performed for transporting four T1s from an Avaya MCC1 Media Gateway (main PN) at the main site to an Avaya SCC1 Media Gateway (remote PN) at the remote site. The same tests were repeated for transporting four E1s.

## 5.1. General Test Approach

The general approach was to validate the execution of maintenance tests for the remote PN and make a variety of calls over the main PN and remote PN. The test calls included voice calls, data calls using modems, and fax calls – off net and on-net calls. Synchronization of remote PN with main PN is critical to the success of this solution and was configured and validated. The main objectives were to verify that:

- The remote PN is up and working when the DS1 Converter link is established.
- The hardware objects on the remote PN, such as DS1-C facility, tone-clock, fiber-link etc., are working properly and can be maintained via Avaya Communication Manager maintenance test commands.
- Resetting the hardware such as DS1 Converter board or remote port network, or resetting the Avaya Communication Manager works properly.
- The on-net voice calls (from main PN to remote PN, or remote PN to main PN) and the off-net voice calls (remote PN to public network via main PN) have good quality and no static or echo.
- Modem calls from the remote PN to the public network via the main PN are successful.
- On-net and Off-net Fax calls are successful.
- DTMF tones can be transmitted successfully from remote PN to the public network.
- The maximum possible calls over the DS1 Connector complex (over 4 T1s or 4 E1s) can be established.
- The system operates properly during and after a load test.

## 5.2. Test Results

All test cases completed successfully. With the appropriate synchronization of main PN and remote PN, the voice, data and fax calls were successful. The following behavior was observed in one of the scenarios:

1. DTMF tones are transmitted from remote PN to public network successfully. However, when the digit keys are pressed and released on the telephone, even after the key is released, the DTMF tone is heard for another fraction of a second as if it is being echoed.


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# 6. Verification Steps

The following steps may be used to verify the configuration and connectivity:

- Verify that the remote PN is deriving synchronization from the DS1C facility, as described in Section 4.2.2.
- Verify that a voice call from remote PN to main PN is successful.

# 7. Support

For technical support on the RAD product line, consult www.rad.com or contact RAD Technical Support at phone number 1-800-444-7234.

# 8. Conclusion

These Application Notes describe the compliance-tested configuration utilizing the RAD Data Communication IPmux-14 TDMoIP Gateway and Avaya S8700 Media Server Multi-Connect configuration running Avaya Communication Manager, to support DS1 Converter Remote Port Network connectivity (T1/E1) over an IP network.

# 9. Additional References

The following documents are relevant to these Application Notes:


1) *Administrator's Guide for Avaya Communication Manager*, Issue 8, June 2004, Document Number 555-233-506.
2) *Avaya Maintenance Alarms Reference*, Nov 2003, Document Number 555-245-102.
3) *Avaya Maintenance Commands Reference*, Nov 2003, Document Number 555-245-101.
4) RAD IPmux-14 TDMoIP Gateway Installation and Operation Manual


Additional product documentation for Avaya products may be found at http://support.avaya.com and for RAD products at http://www.rad.com.



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